THE FALLACY OF AMELIORATION: THINKING THROUGH KNOWLEDGE TRANSLATION IN SPORT AND EXERCISE MEDICINE

Running title: *Knowledge Translation and the amelioration fallacy*

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Abstract: Knowledge Translation, as a component of implementation science, has seen extensive popularisation in Sport and Exercise Medicine (SEM) over recent years. However, in seeking better and more influential outcomes, much of SEM appears to be following Knowledge Translation fashion and fad, over ensuring function and form. This has meant that key concepts in Knowledge Translation have been conflated, the work oversimplified, and potential outcomes overhyped. In this paper, Knowledge Translation is, first, defined as a process. Next, we show how oversimplified versions of Knowledge Translation rely on the 'fallacy of amelioration', with problematic consequences and unintended outcomes. Finally, we move to rethinking Knowledge Translation in SEM by showing how the field can move forward through embracing Knowledge Translation as a complex process to maximise the influence and impact of its work.

Key words: Knowledge Translation, Efficacy, Effectiveness, Intervention, Injury Prevention, Complexity

In seeking better and more influential outcomes, a scan of recent literature suggests that sport and exercise medicine (SEM) is following Knowledge Translation fashion and fad, over function and form. In the pursuit of improving public health outcomes, there is always a need to better disseminate findings that are clinically important, influential, and at times even interesting. Yet, there remains a more pressing need for the SEM field to do the complex Knowledge Translation work that is, ultimately, *imperative*, to ensure outcomes are successful.

Knowledge Translation, as a component of implementation science, has seen extensive popularisation in SEM over recent years[1-9]. Particularly in the area of sports injury prevention research, where translation-related concepts such as programme reach[10], as well as dissemination and implementation research[1, 11] are now recognised as key to improving intervention outcomes. Yet, this advancement has occurred with little concomitant commitment to understanding the function and form of Knowledge Translation as a whole. In reality in SEM, key concepts in Knowledge Translation are too often conflated, the work oversimplified, and potential outcomes overhyped. A reason for this, as O'Brien and Finch[12] showed through a systematic review of the implementation of injury prevention exercise programmes in team ball sports, is that interventions which are shown to be efficacious and subsequently disseminated into 'real-world' contexts inevitably fail to systematically examine the influence that key contextual components have on outcomes of effectiveness.

Numerous important examples of this failure to address context in SEM research exists. The most recognisable may be that of the 11+ neuromuscular control training programme. The 11+ was developed by the Santa Monica Orthopaedic and Sports Medicine Research Foundation, and the Oslo Sports Trauma Research Centre in 2006 (http://f-marc.com/11plus/home/). The 11+ is the most widely evaluated sports injury prevention intervention. For example, in an early study, the 11+ was empirically shown to 'work' through a 2008 trial of young female footballers in Norway, where players had 37% fewer training, 29% fewer match, and 50% fewer severe injuries[13]. When compliance with the full programme was assessed in a further RCT of young female Norwegian football players, it was found that high compliance corresponded with significantly lower injury risk[14]. Other trials of the 11+ have also shown efficacy around various components associated with injury risk, such as functional balance[15], neuromuscular control and knee flexor strength[16,17], as well as static/dynamic balance and thigh muscle strength[18-21]. Therefore, the 11+ is considered

clearly efficacious for key measures of sports injury prevention outcomes. It 'works' to prevent certain sports injuries. Yet, the translation of the 11+ into 'real-world' settings has been less than successful. The worldwide uptake of the 11+ was, and remains, low, despite financial and other support from FIFA[22]. The reasons for this are multi-faceted, but hinge on the underpinning assumption that what was proven to 'work' in a closed RCT in a high-income country, would work when simply translated to football clubs around the world. However, unforeseen implementation barriers have been encountered in 'real-world' settings, including a lack of dedication and motivation to use the programme[22].

Similarly, the Nordic Hamstring exercise programme was developed with the aim of preventing hamstring injuries[23]. The efficacy of the Nordic Hamstring exercise intervention has been shown in controlled trials to reduce the risk of hamstring injuries by at least 50%[23-25], and therefore is another example of a clearly efficacious intervention – it 'works' to prevent injury. However, the Nordic Hamstring exercise programme[23] was recently found to not have been adopted or implemented by the majority of Champions League or Norwegian Premier League football teams[24]. This is despite: 1) hamstring injuries being one of the top injury concerns in this population, 2) the intervention itself being proven highly efficacious, 3) knowledge of the intervention being high, and 4) these being professional leagues that supposedly would have both the time and intrinsic motivation to implement such an intervention[24].

In the important but relatively rapid move to 'bridge the gap' between research and practice in SEM through more and better dissemination, it is worth considering that key concepts, such as Knowledge Translation, have been overlooked or poorly understood and applied. Whilst a more recent turn has been made towards implementation research, most notably through the Translating Research into Injury Prevention Practice framework,[11] there remains a need to pause, reflect, and take stock of the current nature of translational research in SEM. This piece, therefore, focuses on current understandings of Knowledge Translation as a recognised means of 'bridging the gap' in SEM. Specifically, like the recognised gaps in application of behavioural and social science theory to sports injury prevention,[26] where there has been very little consideration of theoretical underpinnings to Knowledge Translation of SEM.

To add to the understanding of these concepts in SEM, we will first define 'Knowledge Translation'. Next, we will show how there is an over-reliance on certain aspects of Knowledge Translation in SEM, and an associated minimisation of others. This is achieved through a discussion of how commonly used versions of Knowledge Translation rely on the 'fallacy of amelioration', and could have problematic consequences and unintended outcomes. Finally, we will move to rethinking Knowledge Translation in SEM. In doing so, we aim to show how SEM can move forward through embracing the complex Knowledge Translation process so as to maximise the influence and impact of its work.

Knowledge Translation: a definition

Knowledge Translation is defined by the Canadian Institutes of Health Research[27] as:

> "a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve [health], provide more effective health services and products and strengthen the health care system."

It is important to note here the four components of Knowledge Translation that arise from this definition[27].

1. Synthesis - whereby research findings are contextualised and integrated
2. Dissemination - wherein the appropriate audience, message, and medium are identified
3. Exchange – whereby mutual learning between the knowledge user and researcher is levered
4. Ethically-sound application of knowledge – wherein "activities for improved health are those that are consistent with ethical principles and norms, social values, as well as legal and other regulatory frameworks – while keeping in mind that principles, values and laws can compete among and between each other at any given point in time"

Further, citing Graham & Tetroe[28], the CIHR[27] critically adds that "this process takes place within a complex system of interactions between researchers and knowledge users which may vary in intensity, complexity and level of engagement depending on the nature of the research and the findings as well as the needs of the particular knowledge user". Similarly,

the World Health Organisation[29] defines Knowledge Translation as "the synthesis, exchange and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people's health". Knowledge Translation then, is multifactorial and complex[30-35].

Knowledge Translation in SEM: an over-reliance on synthesis and dissemination

In SEM, it is generally accepted that efficacy has been proven for a range of interventions, but also acknowledged that effectiveness remains elusive[11]. Therefore, implementation science has been proposed as a way to 'bridge the gap' and achieve better intervention outcomes[1, 11]. As a result, new concepts and terms that describe how to overcome the research-to-practice gap have been introduced into the lexicon, often used interchangeably[36]. These include, for example: reach, awareness, implementation, dissemination, and Knowledge Translation.

The fallacy of amelioration

In SEM, a solution to 'bridging the gap' between research and practice is most often couched solely in the idea that research knowledge must be made more accessible for end-users to understand and use. This is widely signalled by using the term *'Knowledge Translation'* to describe this work.

As a recent example of how this is conceptualised, Barton[6] proposed a four-step process to improve Knowledge Translation in the field of sports injury prevention that includes: 1) complete research, 2) journal publication, 3) multimedia creation, and 4) social media dissemination. Barton[6] further opines that most researchers stop at step 2, and that the barriers to Knowledge Translation for end-users are comprehension, unengaging content, and time restraints. Thereby, 'Knowledge Translation' is conceived as information being transformed into different multimedia formats (infographics, videos etc.), and shared via social media in order for it to be more engaging and accessible for end-users[6]. In this process, the solution to the research-to-practice gap is cast as a need for different, more, or better knowledge *dissemination*.

This approach, however, demonstrates an over-reliance on the 'fallacy of amelioration', which suggests that the problem of Knowledge Translation is merely about an untapped wealth of research knowledge, that simply requires improved mechanisms for *dissemination* to increase effectiveness[37]. In other words, that if knowledge is formatted differently and

distributed better, then Knowledge Translation, and by implication intervention effectiveness, will be achieved. Hanson and colleagues have applied health promotion principles to demonstrate how this is currently limiting sports injury prevention efforts[4,38].

Why is this problematic?

As Green[39(p25)] states, conceptualisations of Knowledge Translation in SEM problematically reflect that "the usual answer to bridging the gap between research and practice or policy is to disseminate research findings more efficiently". The result being that the full extent of Knowledge Translation is cast as a function of *dissemination*, which fails to take into account the other steps and inherent complexity in the full CIHR[27] definition thereof. Indeed, many researchers have flagged this simplistic take on Knowledge Translation as problematic[30-36, 39-40]. How is this so, and why does it matter?

First, as discussed, Knowledge Translation is a much more complex undertaking than is generally acknowledged, in which context and other intervention components must be considered. Thus, overly-simplified conceptions of Knowledge Translation that focus solely on dissemination run the risk of missing, misunderstanding, or misrepresenting the contextual and structural changes necessary to make interventions work in 'real-world' practice – as exemplified by the low uptake of the 11+ and Nordic Hamstring exercise programmes previously discussed. Further, not paying attention to the *exchange of ethically-sound knowledge* and the *complex processes* that underpin Knowledge Translation as a fully-formed concept[27] runs the risk of interventions as according to Hawe[41] that are minimal, negligible or even negligent.

An unintended outcome: too much information

Through a document analysis of lay sports injury prevention resources available on the World Wide Web, Bekker and Finch[42] showed that hundreds of lay sports injury prevention and safety promotion resources have already been disseminated to end-users. For example, across a sample of six key Australian organisations alone, there were 284 different sports injury prevention resources, including an overlap of 15 different concussion resources and 11 different heat/ultraviolet plain language resources[42].

This proliferation of lay resources[42] is a concern that had not previously been identified when suggestions for more and better knowledge dissemination are made. In considering sport settings as complex, open systems[43], everyday choices about injury prevention at sport clubs are clearly varied and infinite. Therefore, a simple either-or choice between simply using, or *not* using, a single resource for a single problem (such as concussion guidelines downloaded from an app in a contact sport environment) represents a false dichotomy. The resulting issue lies in how end-users at sporting organisations are expected to make decisions about which resources to choose and use over a plethora of other, sometimes equally relevant resources[42]. This is particularly the case when multiple resources address the same problem such as concussion guidelines from different organisations in different formats such as apps and posters. Other resources address the other problems that can arise in a complex sporting setting (e.g. forms of non-accidental violence such as harassment)[42]. The challenge becomes that those implementing injury prevention interventions at sporting clubs need to integrate these with what they *already know and do* in that setting for that particular problem, whilst also taking into account the myriad of other risks they seek to mitigate every day.

In this way, the proliferation of multiple, sometimes conflicting, resources may be doing more harm than good. The assumption that people will successfully implement interventions *merely because resources* exist and *are presented in an eye-catching format* is naive[44]. It is known that healthcare research, on average, takes 17 years to be translated into practice[45], and the problem remains that even if people do know about scientific evidence, they are often unsure of how to use it anyway[46]. A newly disseminated resource does not necessarily supersede or replace an old one, rather it just adds to the complex array of existing resources and requires greater responsibility and effort from those working at community sport clubs to implement, despite the fact that end-users often have limited time and capacity to do so. Therefore, merely disseminating research findings to end-users in more attractive or accessible formats is not enough, as many end-users at sporting organisations are not equipped to, or adept at, effectively adopting, implementing, maintaining or monitoring the outcomes of research-based interventions and guidelines into policy/practice[37, 47].

Calls for more and better information formatting and dissemination may, therefore, contribute to the existence of *too much information* to ultimately be useful to end-users – paradoxically decreasing the chances of successful intervention implementation. Understanding the relevance, amount, and type of knowledge (both academic and lay) that is created in the first

place, rather than simply locating the Knowledge Translation issue as a 'gap' that must be overcome through more resource formatting and dissemination, is a much-needed perspective in SEM.

Rethinking Knowledge Translation in SEM

Recently, SEM has moved to recognising sport, injury, and its prevention as inherently complex[43, 48]. Similarly, as stated above, Knowledge Translation is a complex process[27]. Yet, in SEM, full Knowledge Translation frameworks are still considered "far too complex and theoretically driven to work in the real world"[6(p59)].

We concede that Knowledge Translation is often a costly and lengthy process. Further, that traditional single-disciplinary approaches preclude the multi- and inter-disciplinary research approaches that Knowledge Translation research relies on[34, 49-50]. However, with increasing recognition that the world is complex, we need to find ways to work in and with that complexity rather than ignoring it or writing it out[43]. Indeed, Glasgow & Emmons[49] refer to this as the 'connectedness' necessary to increase translation of research into policy and practice.

Knowledge Translation, then, cannot only be about *dissemination*, as we have shown, but rather needs to embrace the full complexity of the process of Knowledge Translation itself. As sport settings are open systems with moving parts[43], fidelity of, and institutional memory about, interventions may not be consistent over time. With each new season of sports participation, the composition of the team or club may change, and new participants may bring new understandings, resources, or decide to change policy or practice[43]. Despite the fact that an intervention, or even end-user knowledge, may be efficacious and effective in one season, does not mean that it will be in the next, or that previous successes in sport injury prevention can be replicated[51]. In this way, sport safety is continually 'becoming'. In other words, safety within sport settings is a state that must be sought each new day, hour, and minute that sport is participated in, and therefore is never fully 'achieved' or 'not achieved'[52]. It is important, therefore, to recognise that safety within sport settings is an ongoing process, rather than an outcome[52]. By moving to understand sport safety as a process, profound and novel insights will emerge that will also influence the systemic structural change necessary to address complex incorrigible problems[43, 48, 52]. On this view, dissemination of information

will never be enough on its own. It is vital to do the complex Knowledge Translation work if better injury prevention outcomes are to be achieved.

Conclusion

In conclusion, we are in agreement with Green[39(p25)] who states that "perhaps the question should not be how do we get more and better dissemination and implementation of the existing science to practitioners and policymakers, but instead, how do we ask the right questions in the first place and, in turn, how do we get better adaptation of the research practices into the real world". The practice to date of placing the onus on the 'fallacy of amelioration', 'content delivery', or simple forms of 'Knowledge Translation' to solve complex social problems has been hampering meaningful change at a systemic and structural level that can better contribute to sports safety. Applying a complexity approach to sports injury prevention, and thinking through the outcomes of current approaches to research, enables a deeper understanding of 'what works, for whom, when, where, why, and how' in order to improve the relevance of research knowledge, and to better address the outcomes sought[42].

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